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AS A HOME FOR WILDLIFE

FROM

THE WESTERN RANGE—A GREAT
BUT NEGLECTED NATURAL RESOURCE

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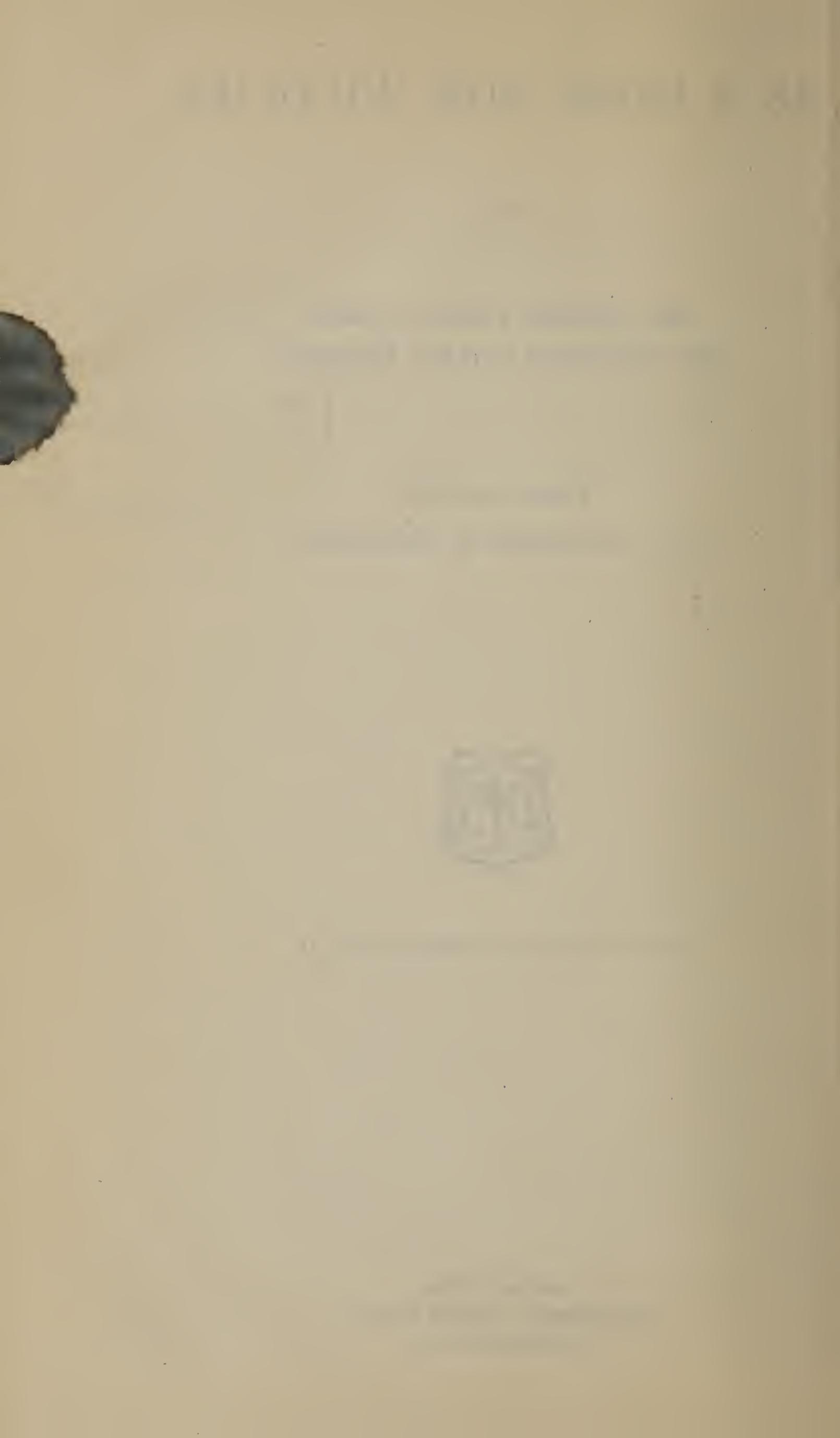
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AS A HOME FOR WILDLIFE

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THE WILDLIFE PROBLEM

Within the limitations set by the needs of civilization for lands and waters formerly supporting game and fish, the two problems of coordinate importance in wildlife conservation are to work toward the opportunity for hunting and fishing characteristics of earlier days, and to rebuild the formerly abundant opportunities for esthetic enjoyment of wildlife. The solution of the first problem reduced to terms of practical achievement has three important phases: First, to restore total population of game birds, game and fur-bearing animals, and game fish to a level that will make hunting, fishing, and trapping more generally available than they are now; second, to accomplish the widest possible geographic distribution of this population—that is, ready availability to hunters and fishermen; third, to increase largely the total area on which hunting and fishing at a nominal charge or no charge for the privilege will give opportunity to the multitudes who cannot afford the luxury of costly field sport.

Solution of the second problem, perpetuation of nongame species and the making available of game species for esthetic enjoyment and observation, on the whole is less difficult and requires less ingenuity than the task of bringing back takable game and fish.

The range lands make up well over one-third of the total area of the country; and are the least complicated by permanent human occupancy of any considerable area. Potentially, therefore, they represent a major opportunity to develop fish and game populations. To understand what these possibilities are, the nature of the biological background for wildlife production and management must be sketched.

WILDLIFE A PRODUCT OF ENVIRONMENT

Wildlife is a product of land and environment, just as are trees, shrubs, or grass. That animal species possess varying degrees of mobility at times obscures but does not alter this fact.

The essential requirements of feed, water, and shelter vary for each species, and are, to a high degree, specific characters determining the range—i. e., the environment—which a species finds suitable. Large groups of both animals and birds, for example, are meat eaters; others are herb eaters; some groups require heavy cover, while others are dwellers in the open. Popular, and to some extent scientific, classification recognizes these inherent characteristics.

The relative inflexibility of the demands of many species for habitats with certain combinations of climate, cover, and water is illustrated by the large number of species found only within indi-

vidual areas of uniform environment. The species that are so biologically adaptable as to succeed in a wide diversity of environment are in the minority.

The adaptation to, and dependence upon, particular total environments has been found, for many species, to tie to key factors. For example, some woodpecker species will nest only in dead trees, and a forest without snags is for them an unacceptable environment.

Thus the process of organic evolution through which each species developed a certain combination of requirements, narrowly or broadly limited as the case might be, results in a total wildlife population in natural balance within itself and with its environment. Within a given habitat the struggle for existence between strong and weak individuals of a species, and between species, produces such a pattern and wealth of wildlife as the early explorers found in the western range country.

When white men first pushed their way into the western range they found a land rich in natural resources. Early accounts of exploration and settlement repeatedly mention the abundant forage and wildlife; for example, in writing of his journey across the Plains in the summer of 1858, Hayden (71) found the prairies clothed with luxuriant growth of grass and literally alive, as far as the eye could reach, with vast herds of grazing buffalo. Reports of first settlement in California tell of countless thousands of deer, elk, antelope, and quail seen in the foothills and valleys, and of the myriads of waterfowl in the lakes and marshes.

In Montana, so the journal of the Lewis and Clark expedition of 1804 to 1806 (37, v. 1) records, the valleys of the upper Missouri and Yellowstone supported an aggregation of game animals that for number and variety exceeded anything elsewhere that the eye of man has ever looked upon. The story of the Northwest is one of abundant wildlife, particularly of beaver and other fur bearers, of fur brigands competing in the wilderness for the largest catch of furs, and of an enormous fur trade. In the Southwest an abundance of antelope over large areas was particularly noted; and in the Rocky Mountain region there was an equal abundance of deer, antelope, wild chickens, and fish. Only in parts of Nevada and Utah, the heavily timbered country of Idaho, and extreme western Montana was a scarcity of game recorded.

It is natural that the early accounts should emphasize the game species, both of land animals and fish, for the food and lives of the early explorers often depended on them. In nongame country, such as that encountered by Lewis and Clark in the Selway River country of Idaho, explorers were forced to eat their dogs to live. But later expeditions, scientific in character, found that the nongame species of this relatively undisturbed environment were actually numerous.

How REDUCTION IN RANGE AREA AND ITS DEPLETION REDUCED WILDLIFE

Range depletion, following the rapid occupation of the range country and its violent subjugation to man's use, signified, in its effect on wildlife, not merely reduction in the total quantity of for-

age available, but also practical elimination of many plant species valuable for grazing animals, invasion by worthless species, starting of widespread erosion, destruction of springs and streams, reduction of soil fertility and destruction of essential cover. This is equivalent to saying that profound changes in environment occurred, even where the land was not turned to crop use. The wild land environment, both range and forest, was altered to an extent and at a pace that were catastrophic to its native inhabitants. Progressive drainage of the innumerable small lakes and ponds of western Nebraska and other Plains States destroyed a major breeding ground for waterfowl. Destruction of cover by fire and grazing in the lower hills of the California central valley began the process of restricting the range of the valley quail. The natural balance between summer and winter ranges was disrupted. The advance of civilization, expressed in the taming of the desert and wilderness, the conversion of range into crop land, and especially the depletion of remaining range lands, worked havoc with the natural environments of wildlife, restricting areas available to it, destroying its feed and water, and deteriorating its habitats.

RESTRICTION OF AREA AVAILABLE FOR WILDLIFE

Use of the better range lands for crop production, reclamation of submarginal lands, of waters, the disposal of lands by the States for immediate revenue, the transfer of lands into private ownership without restrictions on mode of use, and dry farming on submarginal lands, often ending in abandonment, have removed or destroyed areas formerly available for wildlife. Generally, settlement for crop agriculture was necessary and inevitable, but in other instances it has not proved to be economically successful. The abandonment of submarginal croplands has left in its wake considerable areas on which cover has been destroyed through plowing or other disturbance. Elsewhere, the continued use of poor lands, an economic loss in human effort, is resulting in injury to wildlife through removal of cover that with efficient use of the land, would have been available to wildlife.

The reduction in total area available to game would be serious enough in directly reducing populations, were it not for the loss of vital seasonal range areas, particularly winter ranges once so abundant.

Prior to settlement, buffalo and antelope occupied the plains and valleys; deer, elk, and mountain sheep were found in the foothills; and mountain goats preferred the inner fastnesses of the mountains. Deer and elk often summered on the foothills and lower mountain slopes and migrated to the plains and valleys for the winter, particularly when snows were heavy. Occupation of the lowlands by communities, fenced ranches, and livestock took over this natural winter range of game and forced them back into the mountains or onto remnants of their former range on the plains. Most of our big game animals today are found in the mountainous areas to which they are not especially well adapted, at least for year-long grazing.

RANGE DEPLETION

The forage stand on the principal forage types used by game during the critical seasons has been depleted over 50 percent in comparison with its virgin condition.

Overgrazing by livestock of the remaining winter game ranges in the foothills and plains has had the further effect of crowding the game onto mountain forest areas that are essentially summer range. Here the game was and often is forced into a less suitable environment in lower reaches of its former summer domain for winter feeding. The forage on many of these areas on the national forests has been reserved for game use, but the bulk of its winter range is under other control or in private ownership and migrating herds find the meager forage supply so vitally needed for wintering already cropped by domestic livestock.

This factor, coupled with the reduced range area, results in starvation and excessive loss from predators in severe winters. At such times ranchers have frequently divided their scanty hay supply with the game to relieve starvation. This situation applies generally throughout the range country. A specific example is in Montana, where it is estimated that in seasons of deep snow less than 5 percent of the gross national-forest area is available to game. This is so inadequate that an estimated 70 percent of the deer and elk are forced outside the forests in critical winters. Here, because of depleted forage on public domain and private ranges, many of them invade farm pastures and hay stacks, in order to survive.

Many instances illustrate the effects upon elk and deer herds of this restricted and depleted winter range. For example, the winters of 1930-31 and 1931-32 are estimated to have brought death to nearly 35 percent (and as high as 75 percent in some localities) of western Montana's deer; during the winter of 1932-33, on the South Fork of Flathead, 500 elk starved or were killed.

The two most obvious and glaring examples are the Sun River and the northern (or Yellowstone) elk herds. On Sun River, in the Lewis and Clark National Forest of Montana, a herd of elk on the Sun River game preserve was built up over a series of favorable winters to about 4,600 animals. This was a larger number than the available winter range could normally support. During winters of deep or crusted snow, such as that of 1919-20, feed areas were reduced to a few ridges blown bare of snow and isolated pockets or strips supporting browse on or near stream courses. In the fall of 1930 heavy storms drove a big proportion of the herd to the valleys, where 1,070 head were shot down by men and women on foot and on horseback, in farm wagons, and in city automobiles. Subsequent losses from starvation on the limited range area were very heavy, and by 1934 it was doubtful if the herd numbered more than 3,000 elk.

The northern elk herd, enjoying nearly 15 years of favorable weather conditions, increased to more than 15,000 by the fall of 1919. But that winter heavy snows fell early, forcing the animals down to range already cropped short by domestic stock. A toll of some 4,000 head was immediately taken by hunters. But as the winter advanced and snows became deeper and badly crusted, the slaughter during the hunting season was a merciful thing compared to the suffering

and loss which took place until spring brought relief. The winter of 1922-23 was also bad, and by the spring 1923 it was estimated that this herd which 3½ years earlier had numbered more than 15,000 was down to 8,000 or 9,000 head.

A further effect of range depletion is seen in the competition between two or more wildlife species through overcrowding. Thus on the Sitgreaves National Forest in Arizona the increasing numbers of a planted elk herd are competing more and more with mule deer in the use of winter range to the disadvantage of the deer. If the elk are allowed to continue increasing, it will be only a matter of time until the deer are exterminated, since the taller elk can reach higher on the juniper, a favorite elk and deer forage, and therefore can get food in winter after none is left within reach of the deer. This situation similarly applies to the Blue Mountain region of Oregon where the increasing elk are threatening to drive out the deer because of competition for forage on a depleted winter range.

Deterioration of habitat, through depletion of the range has furthermore resulted in decrease of upland game birds. A good example of this is in the thinning out of quail in the San Joaquin Valley region of California. Quail formerly inhabited the valley by the thousands, and the finest part of their habitat was in the brushy foothills. Overgrazing of these foothill areas and the extensive use of fire in an effort to improve forage has destroyed much of the perennial herbaceous vegetation and low shrubs that furnished not only cover but also food for the quail. The result is an estimated decrease of birds of 25 to 30 percent within the last 15 years. Decrease of quail for similar reasons has taken place at other points, such as along the Rio Grande and in the desert and semidesert areas of Arizona.

Whether the process of range depletion was accompanied by increase in species destructive to the range is uncertain. But at the least, the relative importance of rodents is greater on depleted than on normal range.

Rodents do a great deal of damage to the range in destruction of forage and therein are a contributing factor in reducing wildlife and impeding livestock production. Rodent damage looms large as a factor on ranges of the Southwest. For instance, Taylor (141) states:

In some of our northern Arizona fenced plots, rodents, chiefly prairie dogs, have consumed, cut down, or prevented from growing, 69 percent of the blue-stem, 81 percent of the blue grama, and 100 percent of the sand dropseed. In southern Arizona Rothrock grama and associated grasses in fenced plots have been reduced by jack rabbits and other rodents by 35 to 81 percent.

A single kangaroo-rat burrow may contain as much as 50 bushels of grass seed and there are at times as many as 10 to 12 burrows to the acre. In drought periods when all feed is needed by livestock as well as game and other valuable wildlife, such hoarding by rodents brings about an extremely critical condition. All feed may be exhausted months before new growth can come, increasing starvation losses of livestock and impairing the vigor of wildlife species.

Although settlement of the West has not been unfavorable to animals and birds in every case—as, for instance, a large increase in bobwhite that is evidently the result of the prairies being turned to

farm use. The net effect of profound and widespread alteration of environment is beyond doubt a breaking up of the distribution of many animal and bird species, so that mere islands remain; a reduction in the population per unit of area on lands still occupied; an exodus of the remaining individuals to less favorable environment; an upset of the balance between species.

OTHER CHANGES IN HABITAT

Destruction of former breeding areas by drainage combined with overshooting and the deterioration of feeding conditions by recurrent drought have brought waterfowl to a precarious state (41). Added losses attributable to misuse of land are being brought about by poisoning from a form of botulism, caused by the toxin produced by a common bacterium. The factors making favorable conditions for this causative organism are inadequate water supply and fluctuating water levels resulting in the creation, during periods of hot weather, of alkaline sinks and areas of shallow, stagnant water, mud flats, and their associated decaying organic matter in which toxin may be produced. Botulism in 1932 caused an estimated loss of one-quarter of a million birds at the north end of Great Salt Lake (80). Losses occurred at many other points within the range area but not to such extent as in the Utah-Idaho region. The range area lies in the path of two major waterfowl flyways of North America (fig. 75) and therefore is particularly important to waterfowl for furnishing food and resting places enroute.

The drainage of so many ponds, lakes, and marshes in the Plains States has wiped out most of the local breeding grounds for waterfowl, and much of the land drained has proved to be of very limited agricultural value. In fact, efforts are now being made to restore some of the 5,483,524 acres (158) that have been drained within the range area.

Likewise, because of reduced area by drainage and occupation of other submarginal lands, together with excessive trapping, fur bearers have been greatly reduced in numbers with consequent economic loss. As a general picture, F. G. Ashbrook, of the United States Bureau of Biological Survey,³⁸ states:

The most amazing thing is that with a \$500,000,000 annual turn-over in the retail fur trade even as late as 1929, no one should have started long ago to put the fur trade on a factual basis * * *. Already the annual retail turnover in furs has shrunken to \$150,000,000, and the entire cause cannot be attributed to droughts, floods, and the financial depression.

To point out an example of the value of fur animals as an annual crop, speaking of swamp or marsh lands, Ashbrook further states:

At present market prices (1935), the return on an acre from muskrat pelts alone would furnish an income of from \$7 to \$14 each season. No system of cropping this type of land would produce as much.

Fish suffered major reduction to a similar degree, particularly as range depletion reached an advanced stage. For example, many streams of the Wasatch Range in Utah originally had populations of native trout. Silting of the streams, brought on by overgrazing,

³⁸ Ashbrook, F. G. Fur resources—the stepchild of conservation. An address at the Sixth Annual National Retail Furrier Convention and Trade Exposition, held at Buffalo, N. Y., July 1935. 4 pp. 1935. [Mimeographed.]

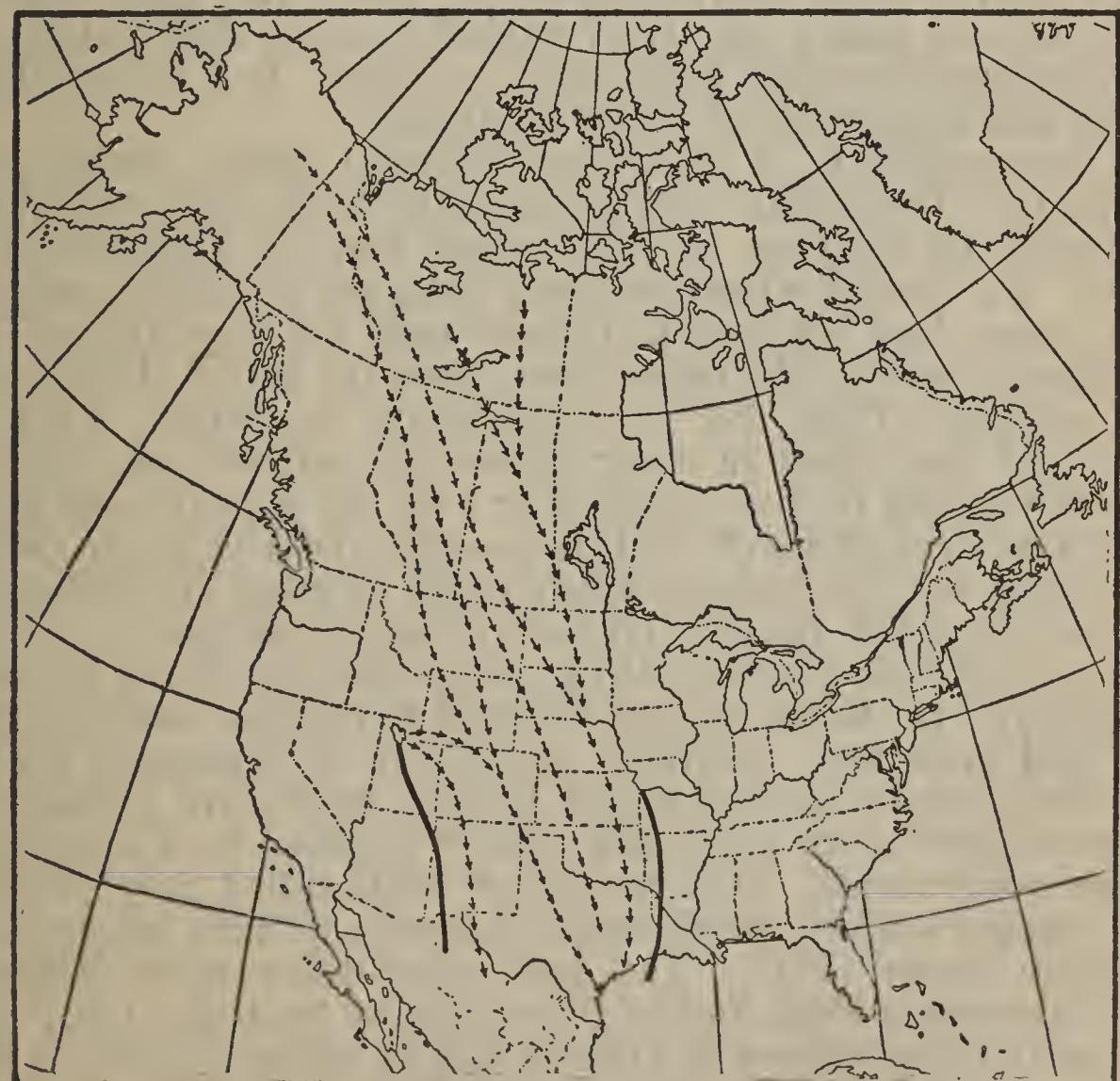
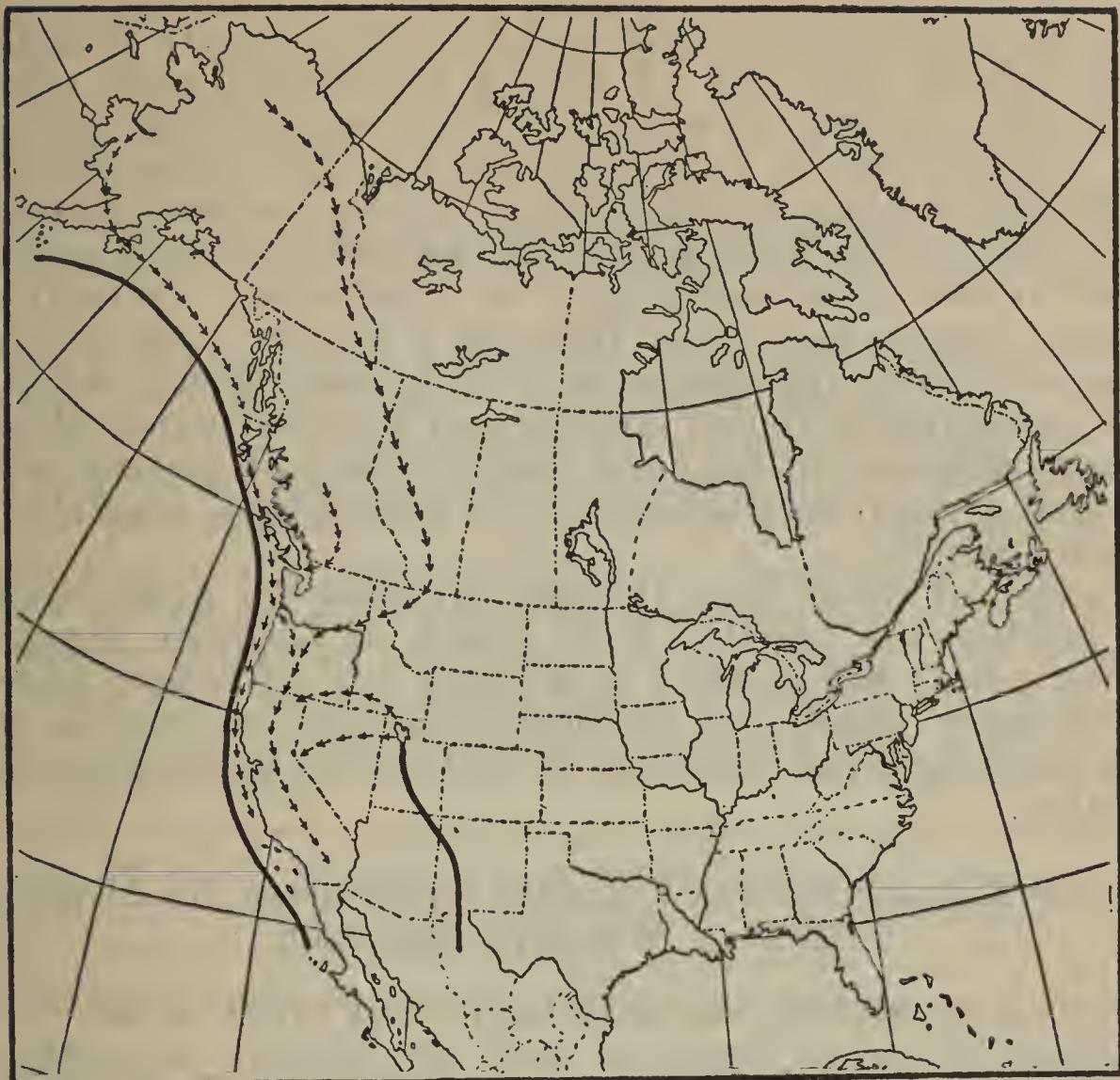


FIGURE 75.—Two principal waterfowl flyways through the range country emphasize the need for an adequate cover to provide watershed protection. The flyway lane in each case is indicated by heavy lines and the tributary migration routes are shown by arrows. Upper, Pacific flyway; lower, central flyway. (From "The Waterfowl Flyways of North America", U. S. Dept. Agr. Circ. 342.)

had by the early eighties destroyed the fish, not only by deterioration of habitat, but also by killing the stream-bank vegetation through the medium of which the food supply was partly provided. The process of halting erosion through conservative range management was begun about 1905, when the national forests were created, but it was 1920 before the environment was sufficiently restored so that trout could again be established. Several of the Montana streams have gone through a similar cycle of natural balance—an initial disturbance of cover by overgrazing or fire; then erosion, resulting in fouled streams and the destruction of stream-bank vegetation and of fish; and finally control of grazing, stopping of erosion, gradual reestablishment of stream-bank vegetation, and restoration of fish.

Reduction of water flows through diversion for power irrigation and municipal use together with a lack of adequate screening at diversion points has resulted in a heavy loss of fishing water and fish. In many places this problem exceeds in importance that of factors resulting from man's use of the land but is much less difficult of solution.

EFFECT OF ENVIRONMENTAL CHANGES INTENSIFIED BY OVERUTILIZATION OF WILDLIFE RESOURCE

Reduction in wildlife was both heavy and rapid, as an inevitable consequence of range depletion and agricultural occupation; but coupled with it went overutilization of game and fish. The early attitude toward usable species of wildlife was no different from the pioneers' attitude toward land, trees, or grass. It was something to be taken and used, without let or hindrance.

The susceptibility to attack of different game species varied enormously. The buffalo was perhaps the most vulnerable, because of its habit of herding, its slow speed, and its existence in open country. Its virtual extinction was a foregone conclusion, even if its natural range had not been so heavily used for agriculture. Other game species, such as the native deer, were far better able to survive man's attacks. They did not congregate in herds. They were speedy, and they lived in cover where concealment was easy.

It is impossible to give an exact or even an approximate estimate of reduction in numbers of wildlife brought about by range depletion and hunting, but the present picture is one of great diminution of all forms, a restricted range, and unfavorable distribution. The remaining wildlife is overcrowded in some sections, scarce or wanting in others, and for the most part confined to refuges, national forests, parks, and preserves. Extreme cases serve to dramatize the situation. The buffalo for the entire United States are reduced from former millions to an estimated 4,400³⁹ confined to a semidomestic state on reservations. One species of white-tailed deer which formerly roamed western Washington is known to have become extinct in modern times (141). The last white-tailed deer disappeared from Yellowstone Park during the winter of 1923-24 (130). It has been nearly exterminated in Oregon and its ranks thinned to alarm-

³⁹ Figures furnished by U. S. Biological Survey, according to a census taken by the American Bison Society issued under date of Jan. 1, 1934 (56).

ing extent in Washington. The prong-horned antelope is still scarce or absent over vast areas in the Southwest where it was formerly abundant, although it is generally on the increase on and near refuges and reservations within the range areas as a whole. Where estimated as formerly numbering not less than 30 to 40 millions, and possibly more (92), antelope now total only about 66,000⁴⁰ for the entire United States, approximately 60,000 being within the range area.

Mountain sheep, moose, and grizzly bear are comparatively few and barely holding their own. (See tables 62 and 63.) Elk and mule deer are suffering from serious overstocking on restricted winter ranges with other areas generally understocked. Elk were so reduced in numbers as recently as 1904 that it was believed that the only way to preserve them was to try to domesticate them. Most species of upland game birds and fur bearers are reduced to scattering remnants of former abundance and are continuing to decline. Many former fish streams are depleted, and waterfowl have decreased to such an alarming extent as to have aroused wide public concern for the future supply.

Man early attacked the animal predators because they found in flocks and herds of domestic stock a ready-at-hand source of feed. The grizzly and the wolf succumbed, but other predators, such as the coyotes and mountain lion, proved to have the biological adaptability needed to insure success in the fight for existence.

REDUCED WILDLIFE PRESENTS AN IMPORTANT AND NEGLECTED PROBLEM

Game especially is of direct economic value not only for food but also because hunters, fishermen, and others attracted by its presence bring money into the community. From the viewpoint of national economics, our wildlife resource represents an annual income running into millions of dollars, which is capable of further increase through intelligent management. The harvesting of the annual crop of game thus forms the basis of an extensive commerce.

The annual value of meat and fur in the range area is estimated at more than \$87,250,000 and the value of fish at approximately \$4,700,000 (154, pp. 495-496). Expenditures by sportsmen for hunting and fishing, including licenses, were estimated for 1930-31 at better than \$40,300,000 for the range area. Tourist expenditures on the national forests within the range area were over \$155,000,000 in 1930-31. Sportsmen's expenditures include purchase of arms, ammunition, fishing tackle, and clothing and outlays for transportation, board, hire of guides, and hunting and fishing privileges on private lands.

Aside from the direct economic values, the pursuit of game for sport and the enjoyment of wildlife for its aesthetic, educational, or scientific interest is a source of renewed health and vigor to a great many men and women who are thus induced each year to spend a period of vigorous life in the open. The number of people that visited the national forests in 1930 for recreational use is estimated at 31,000,000 (149). To many, if not all of these, one of the main attractions was the opportunity to see deer, bear, and other wild creatures in their native habitat. Increase in population, greater

⁴⁰ Estimate based on figures given in New York Zoological Society Bulletin, 1932 (95).

accessibility because of the automobile and good roads, and the time for greater leisure will result in a growing demand for wildlife enjoyment.

A further important value of wildlife is the beneficial effect on range lands—enrichment of soil by the work of burrowing mammals; distribution of seed by birds; influence on streamflow by the work of beaver, where scientifically controlled, in checking rapid run-off and making more favorable conditions for the occupation of streams by fish (113); and insect and rodent control by birds and fur bearers. The destruction of insects by birds within the range area is given an estimated value of \$208,700,000 in protecting agricultural crops (154, pp. 495-496).

This general situation, as affecting economic and social values, is reflected in loss of the fullest enjoyment and profit to be obtained through a balanced use of the range and a sufficiently abundant wildlife to provide hunting, fishing, and recreational and aesthetic benefits commensurate with local and national needs. Often the presence of wildlife is a major attraction of a locality and a source of revenue to the community in the expenditures by tourists and hunters. The large deer herd in the Kaibab National Forest is a great attraction annually to the many visitors to the Grand Canyon. In the Southwest there is so much desert waste land that the presence of game in the mountain areas becomes a major attraction and therefore of great economic importance. Similarly, in the mountainous region of Montana, where so much area is of little use to livestock, is inaccessible, and has only low-value timber, the presence of game and desirable fishing streams is a real asset. The more support a community receives from outside revenue, such as may be attracted by the presence of wildlife, the less it needs to tax its local residents. Aside from this, the presence and maintenance of wildlife is of benefit to the local resident for his own enjoyment. Its curtailment, therefore, beyond a reasonable need for other use of land is a distinct loss.

Recently, because of the serious decrease in waterfowl, a general cut in the bag limit for ducks had to be made throughout the United States and the hunting season shortened. This entailed a loss not only to the hunter in limited enjoyment, but to the community as well in loss of revenue. The decreasing number of fur bearers and game birds, and the increase of depleted trout streams, have resulted in the loss (to the farmer and his son, particularly, but also to others) of the profit and enjoyment that comes from trapping, fishing, and hunting. Likewise even to the city dweller there is loss of opportunity for healthy recreation, whether it be in whipping a stream for trout, gunning for rabbits or quail, or observing big game in its natural environment. And to the tourist and sportsman there must surely be a disappointment in viewing an overgrazed range as a setting for wildlife, or in failing to see the wildlife forms that had been anticipated. Thus the fullest economic and social values of wildlife are affected adversely by the present condition, and the need of a remedy is indicated.

For decades the process of direct depletion of wildlife continued without serious effort to halt it. Naturally enough, the initial preoccupation of the pioneers with the struggle to subdue a new country, and the easy assumption that game and fish, like forests, grass, and

farm land, were inexhaustible, left only a few to think of future problems. Man necessarily lived in the here and now.

Prior to 1900 there was very little thought of the need for protection of wildlife. It had been so abundant that restrictions were not deemed necessary. It was not until the end of the game resource was definitely in sight that any action toward wildlife conservation was sought.

First steps were State game legislation to establish seasons and bag limits for game and the creation of control and enforcement under a county and later State game-commission system. A contemporary and most vital development was the building up of favorable public sentiment in favor of game conservation and law enforcement. A further step was the establishment of many State and Federal game refuges and preserves for protection of wildlife. This was followed by transplanting and propagation of game stock; fish were replaced in depleted streams; game animals were reestablished on depleted areas in various localities; and replacement and supplementing of upland game birds were brought about by introduction of exotic species, such as the ringneck pheasant and Hungarian partridge.

DEFECTS IN THEORIES ADOPTED IN WILDLIFE CONSERVATION

The early attempts at wildlife management were based (as is, indeed, the general pattern of action to date) on the premise that with merely restrictive laws and their effective enforcement, perpetuation of any species could be accomplished. That this whole approach to the problem of wildlife management is biologically unsound has become increasingly evident, as populations of wildlife—particularly of game birds, animals, and fish—have continued to decrease, despite more and more laws and more and more officers to enforce them.

WILDLIFE NOT REGARDED AS A CROP

One underlying difficulty has been that the public mind has had no appreciation of wildlife as a crop, the produce or surplus of which is to be annually harvested, and hence has had little concept of the possibilities of wildlife management. Leopold (85) briefly defines game management as "the art of making land produce sustained annual crops of wild game for recreation use." This implies not only conservation in its broadest sense and correction of past abuses that come about as a result of settlement and lack of understanding but also the control of numbers in accordance with the available feed.

An added factor in the overbalance of game has been the inadequacy of control of numbers under the average buck law. This fails to consider breeding needs, results in an overabundance of does, and a corresponding large increase in the herd that contributes to local overstocking. In many places, as for example the Modoc, Lassen, and Shasta National Forests in California, owing to overprotection by refuge, predatory-animal control, and bag limits, the deer population has grown beyond the grazing capacity of the winter ranges. These factors of overprotection have also applied in many other cases of game overpopulation, such as on the Kaibab Plateau and on the Gila National Forest.

Predator control must not only stop short of elimination of predators; it must avoid the equally disastrous error of permitting too large a number of predators to remain. For example, insufficient control or kill of mountain lions in California has resulted in a great increase of these predators on the coast ranges and in the northern part of the State. This is contributing to material reductions in what until recently were rather large herds of deer and to what are now understocked conditions on the deer ranges in these sections, which being close to San Francisco and other bay cities furnish sport for thousands of hunters. The importance of predators in rodent control, moreover, should not be overlooked. For example, in Colorado it is felt that weasel, if properly protected, would accomplish in rodent control as much as or more than the present poisoning methods. That weasels are not protected in Colorado and are now scarce is considered a contributing factor in the increase of rodents in that State.

WILDLIFE TREATED APART FROM ENVIRONMENT

Another difficulty in management has been that legal theory separated wildlife from its environment. Thus arose inevitable conflict in administration through the claim to jurisdiction over game by the States, irrespective of ownership of the land occupied by the game. The legal status of the game on nationally owned or private lands has never been definitely settled. Too abundant game may be destructive to forest reproduction or to watershed and may seriously interfere with the proper regulation of the grazing of domestic livestock essential to the maintenance of established communities. Proper game management calls for the maintenance of numbers on the basis of available forage and with due regard to other local needs. Often the necessary killing of surplus game on overpopulated ranges runs counter to the provisions of State game laws. Under the present system of divided authority it is very difficult to work out an effective reconciliation of the points of conflict.

This is illustrated in the problem of reducing surplus elk in the Pecos herd on the Santa Fe National Forest in New Mexico (127) and the Sitgreaves herd on the Sitgreaves and Coconino National Forests in Arizona (110). Here again the management problem is one of holding numbers to the grazing capacity of the range in full consideration of livestock and other crop needs. The removal of surplus animals is not provided for under the present State control of game. On the Sitgreaves the elk increased from an original plant of 75 in 1913 to approximately 3,300 head in 1934. The optimum number to be maintained on this area is placed at 2,000 head. On the Santa Fe, the elk increased from an original plant of 47 in 1915, of which 18 are supposed to have survived, to an estimated 1,100 in 1934. The optimum number to be maintained here is placed at 1,000 head. The need of management control and reduction of surplus game on the above areas is apparent but meets with the difficulty of conflict with State law.

Another environmental obstacle in wildlife management in the West is the diversification of ownership of the land which has greatly complicated any unified program of management. National parks furnish a haven for wildlife and can be of great value in its

production, if a proper balance is maintained under a uniform and correlated program of management applying to all areas. National forests have immense areas of land occupied by wildlife that are little if at all used by domestic livestock (fig. 76). In Montana

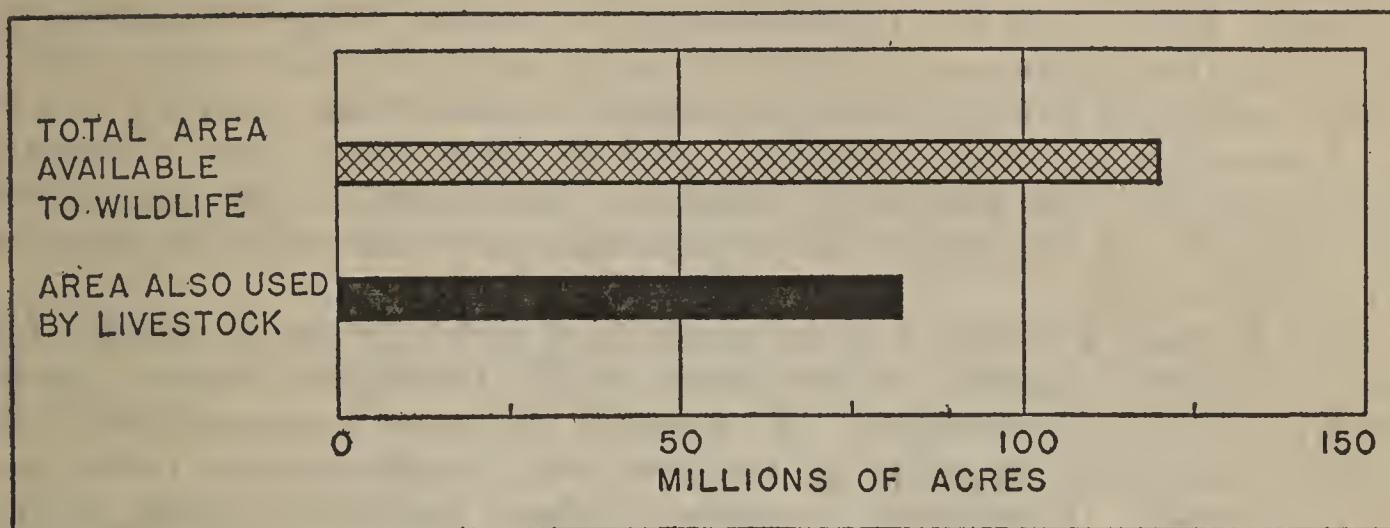


FIGURE 76.—National-forest areas available to wildlife, including those used by livestock.

alone is 9,289,104 acres of such land, representing 57 percent of the net area of national forests in the State. Such lands, in addition to those closed for game, recreation, watershed protection, or other use, are inaccessible to livestock because of heavy timber, down timber, or rugged topography. Because of this large available acreage the setting aside of separate areas for wildlife has been necessary only to meet specific needs, such as particular breeding grounds, winter range, etc. On lands properly grazed by livestock there will ordinarily be abundant cover and sufficient food supplies to maintain a reasonable stocking of wildlife. For example, the national forests of Colorado are estimated to afford adequate summer range for two or three times the present number of game animals without conflict with livestock, provided sufficient winter range is made available for the wildlife on adjoining public domain.

On private lands there is little to encourage the owner to protect wildlife other than his natural liking for it. Still, if the owner provides some food and cover in wood lot, windbreak, or hedge, the land can contribute both to private use and wildlife supply, particularly of small-game species such as quail, grouse, pheasants, and rabbits.

On the open public domain there is a more serious situation in wildlife maintenance. Owing to heavy overgrazing by livestock, food and cover for wildlife have been removed or greatly depreciated. Management of the forage resource of the public domain is greatly needed and should be coordinated with that on other lands for development of wildlife in proper relation to other resources and use values. This will add materially to the economic and social enjoyment of the region and Nation.

WILDLIFE REFUGES NOT UNIVERSAL SOLUTION

As operation of restrictive laws failed, the theory of complete protection on specific areas became established, its proponents overlooking the fact that protection from hunting alone may defeat its

own purpose. Protection was the underlying idea in the original concept of the game refuge. It was believed that large refuges, permanently established, would serve as breeding grounds for game, from which increases would drift on to adjacent areas and there furnish hunting. It has been found, however, that this drift to adjacent areas does not materialize, even under hunger compulsion, and that the animals are extraordinarily local in their range (188). This results, in turn, in overpopulation of the refuge, injury to the feed resource in many instances, and in some cases even wholesale starvation for the protected animals. Furthermore, in such cases the capacity of the range is reduced not only for wildlife, but for livestock as well.

The Kaibab Plateau was set aside as a game preserve, chiefly for deer, in 1906. Control of predators by the Biological Survey up to 1923 gave added protection. As a result the deer increased until the forage-producing capacity of the area was insufficient for both deer and livestock. Continued increase in deer, notwithstanding heavy reductions in livestock totaling 77.8 percent between 1910 and 1930, resulted in great damage to the more valuable forage plants and young forest trees. By 1929 biologists estimated that it would take the vegetation, much of it of especial value for the deer, a minimum of 50 years under practically complete protection to regain its original condition. Action has been under way for several years to remedy the situation, and the excess population has already been reduced.

A large area of mountainous country on the Gila National Forest, because of latitude, elevation, and vegetative cover, is peculiarly adapted to the production of deer (102). It is also used by cattle. To protect calves the cattlemen set about to exterminate the mountain lion. There are no available statistics regarding the number of lions removed, but it is known to be large. This destruction of mountain lions served also to protect the deer. Since the area is relatively inaccessible to hunters, the inevitable occurred. The deer herd increased prodigiously, with the result that the cattlemen began to complain that the deer were overrunning their range and threatening to put them out of business. Here, as on the Kaibab, it has been necessary to correct the situation by removing the surplus deer, and also to reduce the number of livestock.

TRANSPLANTING OF WILDLIFE

The artificial planting of areas to game, while often an effective aid in restoring and distributing wildlife, has not always been wise. This is illustrated in the planting of elk on the Pleasant Grove division of the Wasatch National Forest in Utah. Here elk were introduced in a narrow foothill area bounded on one side by the inaccessible Timpanogas Mountain range and on the other side by lands occupied by farms and ranches. These adjoining properties have intense need of the range for domestic livestock. The elk here, which numbered 18 head in 1920, had increased to 209 head by 1934. The restricted range is too small for this increase, particularly for winter forage, with the result that the elk seek food in raids on orchards, gardens, and haystacks of the nearby ranches. The elk

in this instance seriously conflict with the local needs in use of range for livestock, besides doing damage to farm properties.

Widespread attempts to replace depleted stocks of native upland birds by importation of exotics have been only partly successful. To a large extent these efforts beg the question of the real underlying causes of decreasing game population.

LACK OF BASIC KNOWLEDGE OF WILDLIFE A HANDICAP

Underlying all other factors of the present situation on the range is a lack of basic knowledge of wildlife because of which many efforts in protection and restoration have failed. The present information as to wildlife populations and annual kill are fragmentary and inadequate. Much fundamental biological research is needed in regard to wildlife interrelationship, life histories, breeding, and feeding habits of various animals, environmental needs, propagation, enemies, diseases, etc. Principles of good management demand that working plans, not only for the development of the wildlife resource but for its coordination with other forms of land utilization must be based on sound, fundamental facts.

WILDLIFE ADMINISTRATION NOT HANDLED AS A BIOLOGICAL PROBLEM

Because wildlife conservation was based solely on restrictive laws, it was natural that the commissions and boards created to supervise fish and game work, and the field officers employed for law enforcement, were seldom selected for their training in the biological sciences. Just how much might have been accomplished had the States generally used men with professional qualifications rather than political appointees, is perhaps an open question. At least, earlier and more forceful recognition of the underlying structural defects in the edifice of State game and fish management would likely have come.

WILDLIFE MANAGEMENT UNDER LEGAL PATTERN SELF-DEFEATING

The logical outcome of a purely legal approach to wildlife management is either the virtual extermination of species that hunters and fishermen unfailingly bring about, against their own true interest and desire, or the virtual end of hunting and fishing as complete closure to taking becomes necessary through failures inevitable from the very structure of the accepted theory. The yearlong closed season on many species in the range States, forced as a last desperate measure to prevent extinction of valuable game species, testifies alike to the self-defeating nature of management by restrictive laws and to the decreasing opportunity for hunting and fishing.

VITAL IMPORTANCE OF ENVIRONMENT PROVED BY NATIONAL-FOREST EXPERIMENT

That maintenance or restoration of an approximately natural environment is the first essential in restoring wildlife populations has been proved on a large scale on the national forests. For on these public properties, although the taking of wildlife has been

wholly controlled by State law, an essentially natural environment has been maintained or restored.

Probably no single factor has had a more important effect upon the rehabilitation of the wildlife resource on the western range than the establishment of the national forests. Withdrawal of lands for forests insured the maintenance of a suitable wildlife habitat, which was so essential in that critical period if game was to be perpetuated in the face of a rapidly advancing civilization.

TABLE 60.—*Refuges and reserves for wildlife on the western range, inside and outside national forests¹*

State	Inside national forests					
	State-owned		Federal-owned		Under administrative restriction	
	No.	Acres	No.	Acres	No.	Acres
Far western:						
Arizona	45	802,444	3	865,460	5	92,720
California	33	2,082,838	2	20,770	36	418,178
Colorado	22	2,642,280			14	1,325,248
Idaho	26	3,512,757			38	1,129,443
Montana	23	1,514,903				
Nevada	10	932,390				
New Mexico	49	1,144,983	1	45,515		
Oregon	14	795,805			3	170,600
Utah	11	1,351,690				
Washington	25	2,007,194			2	85,802
Wyoming	20	2,546,448	2	84,450	19	321,955
Range portion of Plains States:						
South Dakota	1	34,000	3	51,188		
Nebraska	1	206,026				
All States	280	19,573,758	11	1,067,383	117	3,543,946
 Outside national forests						
State	State-owned			Federal-owned		
	No.	Acres	No.	Acres	No.	Acres
Far western:						
Arizona	6	909,280	2	333,807	56	2,910,991
California	11	544,755	5	89,854	56	2,830,937
Colorado			5	357,360	63	3,417,818
Idaho	4	449,900	2	25,540	46	5,313,445
Montana	9	7	98,626	77	3,690,769	
Nevada	12	4,305,870	5	530,088	27	5,768,348
New Mexico	81	1,217,644	2	91,908	133	2,500,050
Oregon	9	3,381,280	5	244,189	31	4,591,874
Utah	6	591,000	3	79,327	20	2,022,017
Washington	91	1,826,502	8	1,750	126	3,921,248
Wyoming	7	940,960	5	43,418	53	3,937,231
Range portion of Plains States:						
North Dakota	30	68,127	2	11,755	32	79,882
South Dakota	12	156,910	1	13,680	17	255,778
Nebraska	9	1	40,782	11	318,148	
Kansas	2	4,440			2	4,440
Texas	26	2,727,404			26	2,727,404
All States	315	18,143,209	53	1,962,084	776	44,290,380

¹ Sources of data: U. S. Department of Agriculture, Bureau of Biological Survey, Bird Refuges and Big-game Preserves Administered by the Bureau of Biological Survey, Wildlife Research and Management Leaflet BS-16, 7 pp., illus., 1935 (mimeographed); and Forest Service annual fish and game reports, 1935.

² 7 area figures not available.

³ 1 area figure not available.

Table 60 shows the refuges and reserves for wildlife inside and outside the national forests of the western region for 1934. The 44.3 million acres estimated for these tracts amounts to 4.5 percent of the total land in the range country. In addition, as shown in table 61, there are about 20.5 million acres of public and private lands lying inside and outside the national forests that have been recommended by the Forest Service and the Biological Survey for present and future acquisition for the use of wildlife. Thus, only 7 percent of the range country, or 65 million acres, is available in refuges and proposed special areas for the use of wildlife. In addition to these designated wildlife areas, however, there are about 845 million acres of grazing, cultivated, and other land, or 86.7 percent of the total western land area, that under proper use may be made jointly available to the production of wildlife, particularly of the smaller species, such as birds, fur bearers, and fish. Of this area, 721 million acres may be considered as jointly usable by wildlife and domestic livestock. The importance of securing a suitable wildlife management on such an acreage is apparent.

TABLE 61.—*Recommended additional areas for wildlife within the range area inside and outside the national forests*

States	Areas inside national forests		Areas outside national forests		Water-fowl areas ¹ Desired projects	All areas
	Submar-ginal, now oc-cupied	Private land in grazing, not occu-pied	Submar-ginal, needed for wildlife and water-shed	Public do-main needed as supple- mental range		
	Acres	Acres	Acres	Acres		
Arizona				844,000		844,000
California	11,740	55,100	384,540	1,219,093	10,775	1,681,248
Colorado	65,343	271,990	2,733,776	5,441,000	7,360	8,519,469
Idaho	13,408	36,870	259,836	807,561	77,937	1,195,612
Montana	20,066	189,960	202,159	68,783	49,340	530,308
Nevada	485	21,000	12,640	1,597,835	33,560	1,665,528
New Mexico		396,425		523,000	26,623	946,040
Oregon				1,273,000	120,382	1,393,382
Utah	4,043	46,735	471,060	1,733,390	23,559	2,278,787
Washington				158,000	59,851	217,851
Wyoming	9,748	13,779	233,821	515,492	19,025	791,865
North Dakota					124,959	124,959
South Dakota	5,350	65,930	145,000	10,460	14,362	241,102
Nebraska					73,984	73,984
Texas					5,811	5,811
Total	130,183	1,097,789	4,442,832	14,191,614	647,528	20,509,946

¹ U. S. Department of Agriculture, Bureau of Biological Survey, Summary Report of Land Acquisition Progress, Nov. 15, 1935, 5 pp. (Photostated from typed sheets.)

Under protection on the national forests, as also on national parks and State preserves, the population of the principal game species have made phenomenal increases during the past 25 years. More efficient law enforcement and consideration of wildlife problems by States and other agencies concerned have contributed to this improve-

ment. Table 62 shows the estimates of wildlife on the national forests within the range area for 1934. Figure 77 and table 63 show the trend of big-game populations on national forests since 1924. It is estimated that the increase in numbers of all big-game animals on the national forests during the period 1924-34 is about 77 percent.

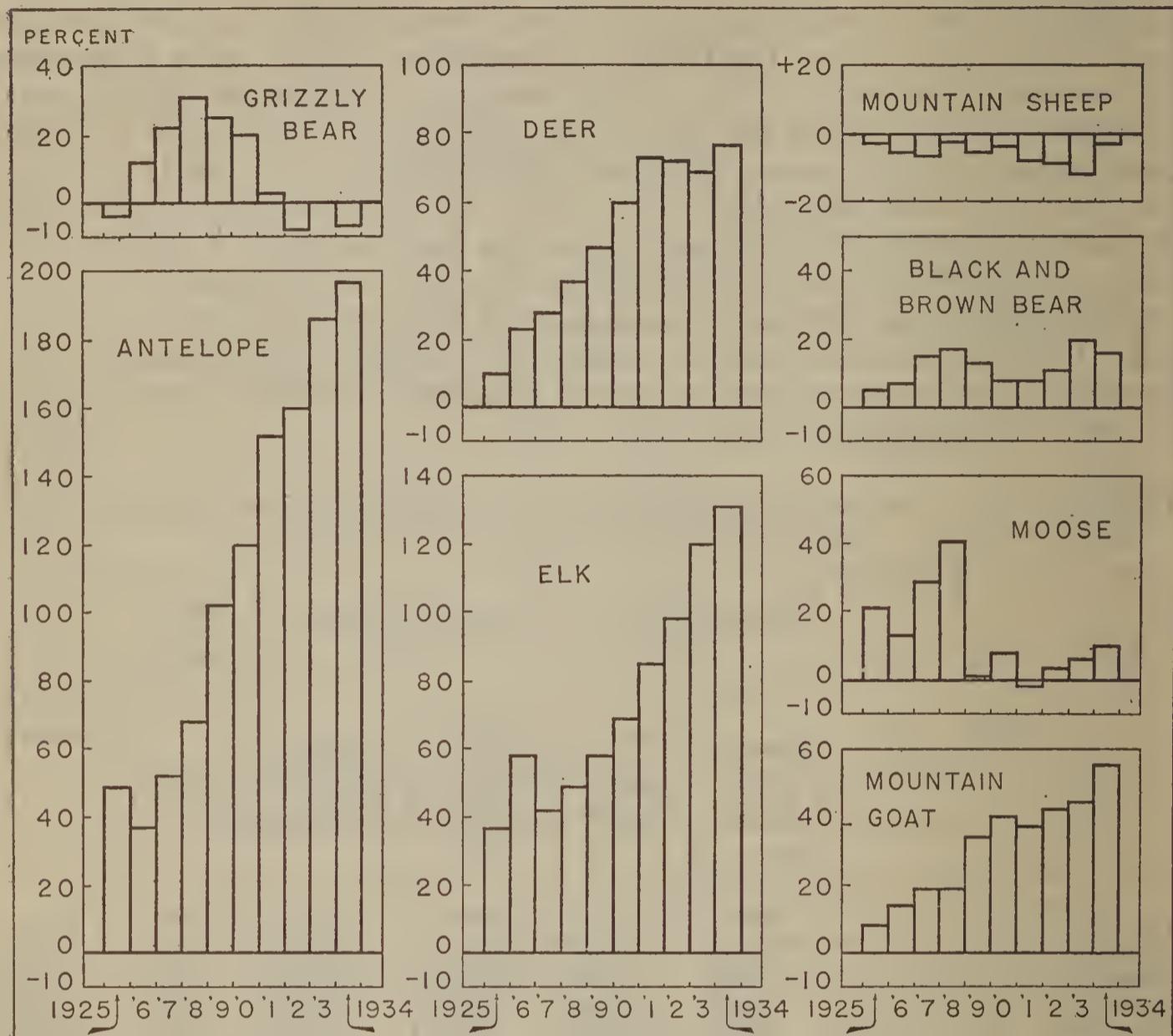


FIGURE 77.—INCREASE OR DECREASE OF BIG GAME ON NATIONAL FORESTS.

The decrease in moose and grizzly bear from the 1928 peak is due partly to a change in the method of taking the census and partly to cyclic changes in abundance from unknown causes.

This development is effective as far as it has gone, but it is by no means adequate to growing needs. It is an advance toward securing the social and economic values involved, but a further step is now needed, namely, to obtain management of the wildlife resources on a more comprehensive plan that will cover the range area as a whole and be based upon an environmental control determined by research. Leopold (85) states:

Both scientists and sportsmen now see that effective conservation requires, in addition to public sentiment and laws, a deliberate and purposeful manipulation of the environment—the same kind of manipulation as is employed in forestry. They are also beginning to see that in game, as in forestry, this manipulation can be accomplished only by the landowner, and that the private landowner must be given some kind of an incentive for undertaking it.

TABLE 62.—Estimates of wildlife on national forests within the range area, Dec. 31, 1934.¹

Animals	Arizona	California	Colorado	Idaho	Montana	Nebraska	Nevada	New Mexico	Oklahoma	Oregon	South Dakota	Utah	Washington	Wyoming	All States
Big-game antelope	5,040	2,220	224	4,116	1,106	220	2	930	430	12	100	8,226	615	15,013	
Black or brown bear	790	11,431	3,362	4,999	5,642	5,455	5	1,275	4	5,621	601	1,753	1,139	43,706	
Grizzly bear	7		3	55	55	55	167	11,253	3		4	6	27,215	672	
Deer	91,050	256,950	59,570	63,597	11,706	20,420	15,276	97,400	1,000	88,607	5,055	36,343	40,308	874,844	
Erik	4,721	121		597	597	1,955		1,302	345	13,068	222	3,186	2,478	120,520	
Moose				3,463	4,190									5,030	
Mountain goats	188		442	3,002	1,891	1,581								12,742	
Mountain sheep								170	106					11,620	
Total	101,796	271,164	81,437	90,424	91,126	167	11,705	101,016	1,349	107,776	5,305	84,910	58,962	77,010	
Predatory coyote		67,195	19,730	23,210	16,833	350	8,875			20,659	1,900	13,347	14,145	1,084,147	
Cat or lynx		25,270	5,176	4,659	3,013	2,335	2,335			6,632	1,080	4,446	4,860	9,745	
Mountain lion		1,511	341	818	299	7	71			446	3	768	460	1,570	
Wolf			10	106	7					152		7	28	41	
Total		93,976	25,257	28,793	20,152	350	11,281			135	27,889	2,983	18,568	11,366	260,243
Fur-bearing badger	3,360	9,215	4,562	11,280	13,593	16,188		3,400	1,815	35	3,350	1,015	5,736	2,875	48,038
Beaver	1,096	95	43,820	3,817	3,047	1,851		1,510	110	50	4,214	1,090	3,788	9,761	104,350
Fox	20,200	29,870	12,010	7,877	11,337	10,080		400	400	50	960		1,217	830	70,729
Marten			10,288	7,632	13,155	9,295			50		4,025		1,462	19,865	6,155
Mink	270			28,595	1,225	100			255		11,960	27	2,116	10,195	72,861
Muskrat						229					12,350	1,500	450	15,220	68,868
Otter												585		397	2,156
Raccoon	5,085	4,970	24,200	5,730	40	33,360			1,790	750	11,700	500	920	225	25,970
Skunk	47,100	8,035	47,190						100	1,275	1,875	19,505	4,750	1,300	1,940
Weasel	1,450											21,750	3,350	14,040	18,375
Total	78,561	98,833	149,228	87,805	37,643	235	3,905	33,375	3,100	90,399	12,232	30,109	107,183	53,409	786,017
All animals	180,357	463,973	255,922	207,022	148,921	752	26,891	134,391	4,584	226,064	20,520	133,587	185,638	141,785	2,130,407

¹ In addition: California, 580 ringtail cat and 610 fisher; Montana, 316 buffalo and 6 caribou on national-forest land; Oklahoma, 97 longhorns on national-forest land; and Oregon, 950 ringtail cat.

TABLE 63.—*Numbers and trend of big game on national forests within the range area, 1924-34*

Species	1924	1925	1926	1927	1928	1929
Black and brown bear.....	37,752	39,640	40,563	43,275	44,265	42,767
Grizzly bear.....	724	693	814	880	947	907
Deer.....	492,702	543,411	604,981	630,613	676,144	726,177
Elk.....	52,265	71,820	82,333	74,042	78,075	82,524
Moose.....	4,561	5,516	5,142	5,892	6,421	4,594
Mountain goat.....	8,244	8,887	9,418	9,834	9,798	11,050
Mountain sheep.....	12,033	11,652	11,285	11,242	11,324	11,328
Antelope.....	5,058	7,552	6,942	7,665	8,494	10,219
Total.....	613,339	689,171	761,478	783,443	835,968	889,566

Species	1930	1931	1932	1933	1934
Black and brown bear.....	40,651	40,587	41,961	45,268	43,706
Grizzly bear.....	870	747	664	721	672
Deer.....	786,548	853,280	849,300	834,005	874,844
Elk.....	88,083	96,760	103,745	115,074	120,520
Moose.....	4,904	4,491	4,683	4,821	5,030
Mountain goat.....	11,566	11,262	11,736	11,883	12,742
Mountain sheep.....	11,496	11,055	10,980	10,625	11,620
Antelope.....	11,142	12,725	13,150	14,458	15,013
Total.....	955,260	1,030,907	1,036,219	1,036,855	1,084,147

The unmistakable trend of increase in wildlife population under natural environment, even with the handicap of ill-considered State laws, is in sharp contrast to the general trend of decrease on the more heavily depleted lands in other ownerships and under other managements. This long-term and widespread experiment, although the results simply confirm well-known biologic and ecologic laws, yet points the way to a fresh start in wildlife management.

MAJOR PROBLEMS IN WILDLIFE MANAGEMENT

A fresh start toward restoration of wildlife populations—particularly of game birds and animals, and of fish—requires, first of all, more general acceptance of established biologic and economic facts. These include the following:

1. Wildlife is a product of environment and each species can succeed only under a specific environmental pattern, made up of determinable and (except for climate and elevation) controllable elements.

2. Management of wildlife starts with and is limited by management and manipulation of environment.

3. Lacking established legal power to force conservative management of land and environment, attempts to manage wildlife solely under restrictive game laws can succeed only to the degree that environment is independently maintained and improved. The key to wildlife management rests with land ownership.

4. The legal theory which places title to wildlife in the State, leaves little direct incentive to private or other public owners to manage land in a way to favor wildlife.

5. Game species must be handled on a crop basis, with the annual take adjustable to and definitely set on the basis of annual increase. The problem differs not at all in this respect from that of maintaining continuously productive flocks and herds of domestic birds and animals.

6. In addition, successful wildlife management is a problem in applied biology, and requires, first of all, a factual basis, and secondly, professionally trained men to apply the facts. For game species, such questions as sex ratio, best season for taking, desirable degree of predatory control, and needed environmental changes, must be handled on a flexible basis, adapting action to needs of particular areas at particular times.

7. Given a suitable environment, and management on a crop basis, most wildlife species can succeed on lands used by other wildlife species, and by man and his domestic animals. If handled as a part of conservative multiple-purpose land management, wildlife populations can be maintained or increased. Deliberate attention to such things as reservation of feed for wildlife, both on summer and winter range, are simply a part of good land management.

8. The logical outcome of theories and methods of wildlife management which depend on detailed and rigid laws, as heretofore applied, is further reduction in population.

Restoration of far larger, more widely spread, and more readily available populations of game birds, animals, and fishes, is the heart of the wildlife problem. Hunting and fishing available to all, have been a part of the American tradition. Maintenance of this opportunity for the tens of millions of actual or potential hunters and fishermen who cannot afford to travel far, nor to pay high fees for the privilege, is of increasing importance in the face of increasing leisure.

Inevitably, public lands, managed to produce takable crops of game and fish, must furnish the major opportunity for free public hunting and fishing. The guides to future and effective restoration programs are clear. Restoration of environment, whether of range or forest—a function of land ownership—is the key to restoration of wildlife. Management of wildlife as a crop, in accordance with biological facts and laws, by professionally competent men, is inseparable from management and manipulation of environment and is therefore also a function of land ownership.



